

CASE STUDY REPORT #55
SNELLING PROJECT
MERCED RIVER

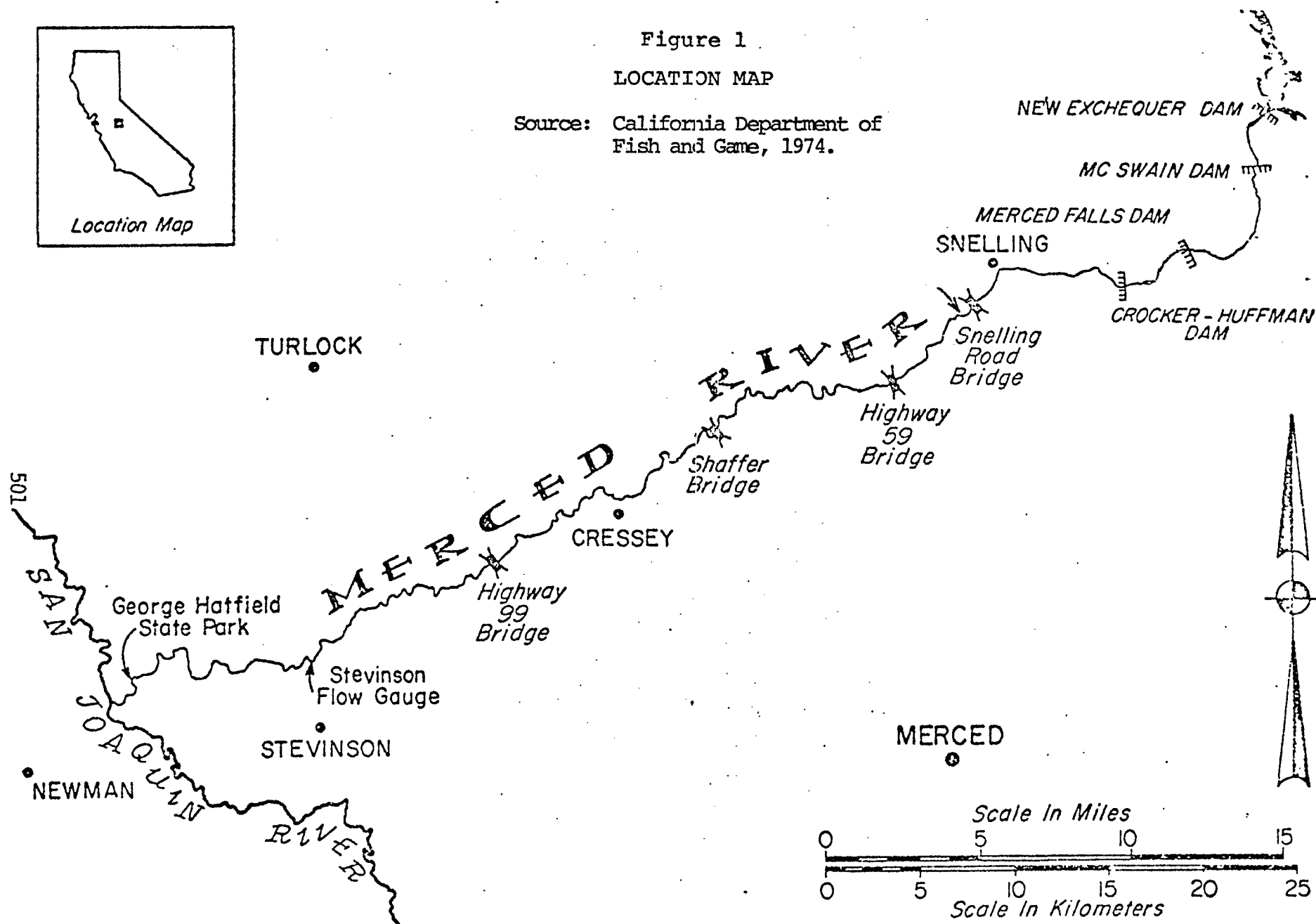
I. Project Description

The Snelling Project consists of an enlargement of the Merced Irrigation Districts (MID) Crocker-Huffman Diversion Dam located 10 miles downstream from the district's New Exchequer Dam (see Case Study Report #54) (see Figure 1). The enlargement of Crocker-Huffman to a maximum storage capacity of 190,000 acre-feet, as proposed by the Merced Irrigation District, was never initiated and the dam presently remains the same as it was originally built in 1910. This small dam (Crocker-Huffman) storing 300 acre-feet of water covering 56 acres is used by the district to divert releases from New Exchequer into the district's main canal (maximum capacity 1700 cfs). A short distance upstream from the Crocker-Huffman Dam is the small Merced Falls Dam which was built by Pacific Gas and Electric Company in 1910. This small dam is used by the Merced district for diversion of water to the district's North Canal (maximum capacity 100 cfs). In 1923, the water supply for the Merced District was increased and stabilized with the construction of Exchequer Dam. This dam's storage capacity was enlarged in 1966 with the construction of New Exchequer Dam (Case Study Report #54).

Figure 1

LOCATION MAP

Source: California Department of
Fish and Game, 1974.



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II. Pre-Project Condition

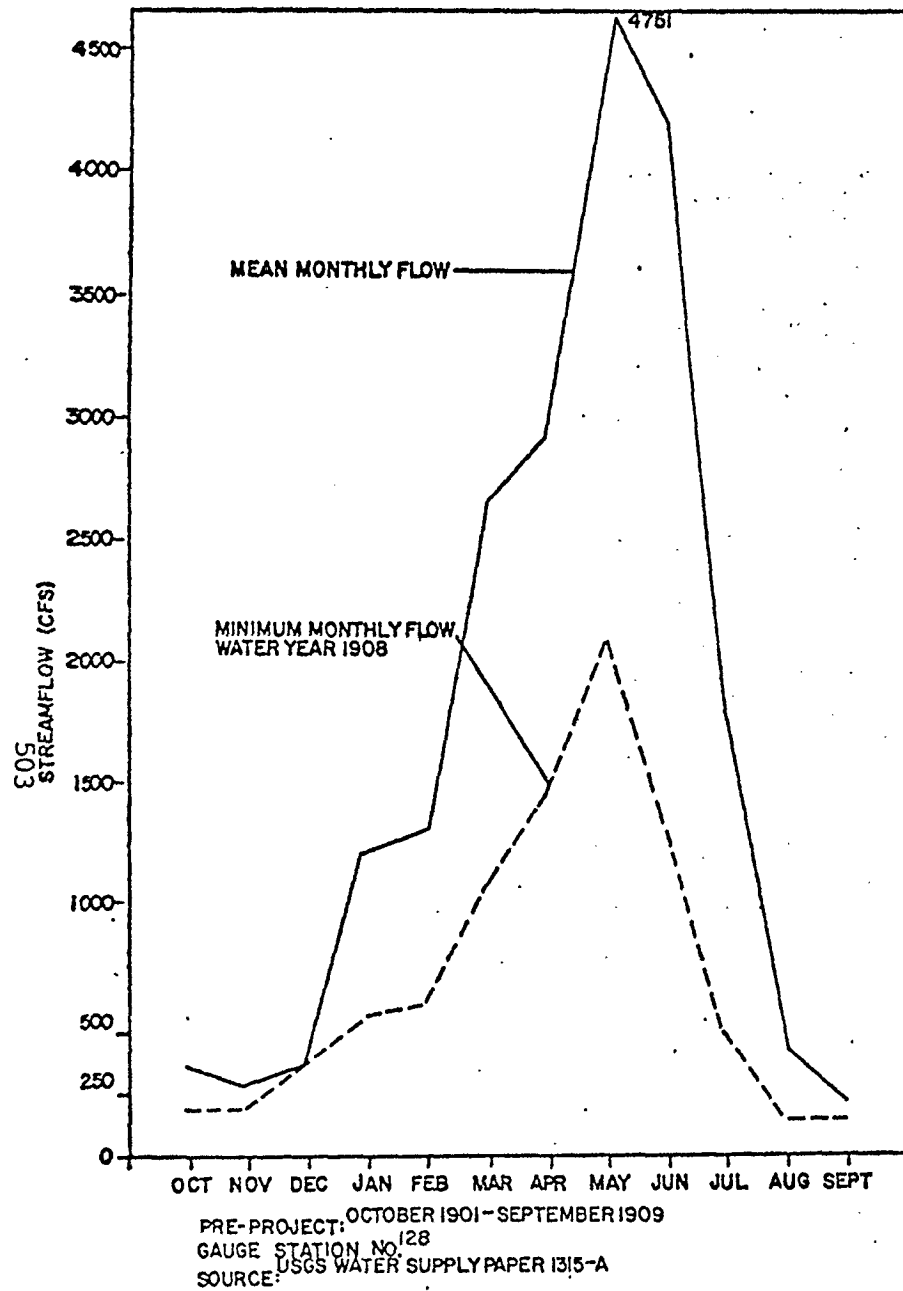
Prior to the construction of Crocker-Huffman Dam (1910) the Merced River had a seasonal distribution of completely unimpaired streamflow similar to other rivers draining the western slopes of the Sierra Nevadas to the San Joaquin Valley. The watershed above the project area consisted of 1,045 square miles with some of this area lying within the heavy snow pack region of the Sierras. During the late spring peak flows averaging over 4000 cfs occurred annually while low flows during the late summer averaged nearly 200 cfs (see Figure 2).

Historically the Merced River supported large populations of spring and fall run king salmon that averaged in total about 12,000 fish per year. There was no information discovered revealing the resident fish populations supported by the lower river prior to 1910.

III. Project Development

During the period between the construction of Crocker-Huffman Dam (1910) and the enlargement of Exchequer Dam very little consideration was given to the conservation of salmon, steelhead or any resident fisheries dependent upon the streamflows of the lower Merced River. The DFG was permitted to reenter this issue with the implementation of the New Exchequer project (1954).

In the initial development of the original project (1910) consideration was given to the need for salmon and steelhead to pass over the dams to reach historical spawning areas. Fishways



POST-PROJECT: OCTOBER 1968-SEPTEMBER 1973 (EXCEPT 1969 WATER YEAR)
 GAUGE STATION NO. 11271290
 SOURCE: USGS SURFACE WATER RECORDS VOL. 2

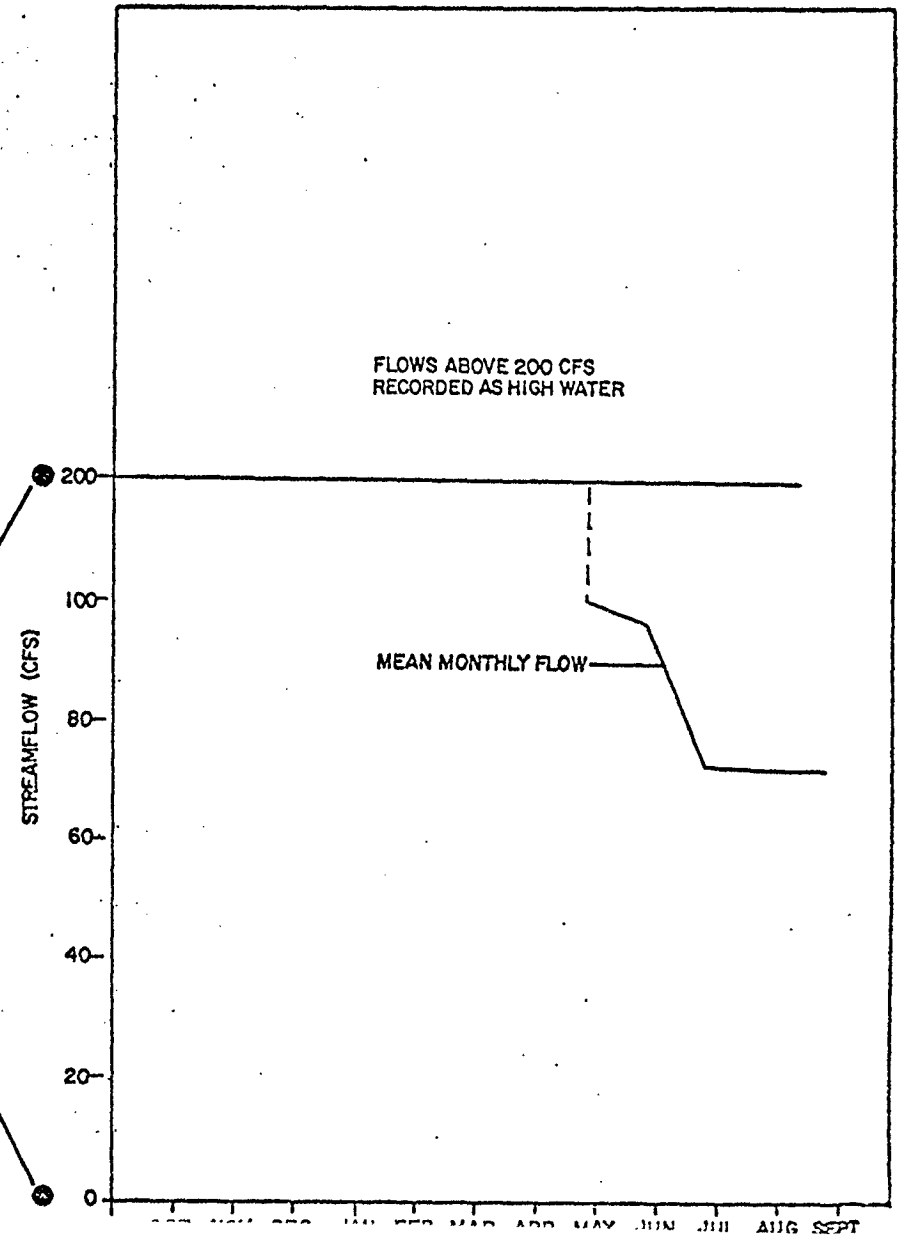


FIGURE 2
 STREAMFLOW CONDITIONS, MERCED RIVER
 AT SHAFFER BRIDGE 43 MILES BELOW CROCKER
 HUFFMAN DAM

were constructed for this purpose on both Crocker-Huffman and Merced Falls Dams. However, the effectiveness of these ladders was highly dependent upon streamflow conditions which were usually poor below the dam.

In 1954 the Merced Irrigation District filed applications (nos. 16186 and 16187) for permits to appropriate unappropriated water from the Merced River which were protested by the DFG. The applications were for the storage of 900,000 acre-feet per annum and for power production at Exchequer Dam, Bagby Dam and Snelling Dam (the latter two dams were never built). Water released from storage was to be used at the District's existing Northside and main canals.

In order to dismiss the DFG's protest, the Merced Irrigation District entered into an agreement with the Department of Fish and Game in October of 1959. This agreement was included in the terms of the water rights permit issued in 1960 to the MID by the State Water Resources Control Board (Decision 976).

The following release schedule concerning the operation of the proposed Snelling Dam was incorporated into the terms of the 1959 agreement.

Minimum Instream Flow Requirements
Merced River at the Shafter Bridge
(43 Miles Downstream From Snelling)

Period	Flow (non dry yr)	Flow (dry yr)
June 1 through October 15	25	15
October 16 through October 31	75	60
November 1 through December 31	100	75
January through May 31	75	60

Other terms included in the agreement required operation of the proposed dam for the maintenance of a stable flow regime and a temperature regime suitable for salmonid reproduction along with minimum instream flow releases for the New Exchequer Dam (see Case Study #54).

In 1964 the Federal Power Commission issued a 50 year license (FPC project no. 2179) for the Merced Irrigation District's Snelling New Exchequer Projects. Included in the terms of the license was the 1959 agreement with the DFG.

The technique used by the Department of Fish and Game to determine these minimum instream flow requirements for the lower Merced River was a usable width method, similar to that used on the Cosumnes River by Westgate (1958).

In October 1966 at the time that New Exchequer and McSwain Dams were completed a king salmon enhancement contract was initiated between the California Department of Water Resources and the Merced Irrigation District under the Davis-Grunsky Act (contract no. D-66-R17). This act provides a public agency with a grant for the part of the construction costs of the proposed project that is allocated to the enhancement of fish and wildlife or for recreational interests. (Grants applied toward these specific costs cannot exceed 50 per cent).

The Merced River spawning channel was built by the MID with part of the Davis-Grunsky Act funds received by the district for recreation and fish enhancement. The spawning channel is immediately downstream from Crocker-Huffman Dam near the upper limit

of salmon migration. The channel is made up of one loop containing seven spawning channels. Optimum spawning conditions occur at a flow of 200 cfs in the channel. Two gravel rearing ponds are at the end of the channel.

In the contract the district agreed to maintain the total area of spawning gravel present in the river as quantified by a 1966 DFG survey. In order to compensate for the loss of any gravels the district has purchased additional property adjacent to the existing spawning channel. The district has also installed effective screens on all the diversions present on the lower river as required by the contract (Toffoli, pers. comm.).

The provision for minimum flows is another feature of the salmon enhancement program. Under the Davis-Grunsky Grant Agreement, MID guarantees to release between 180 and 220 cfs in the river between November and April. The methodology used by the Department of Fish and Game to determine the minimum instream flow requirements on enhancement flows was similar to the original study conducted in 1959 (see Case Study #54) (Toffoli, pers. comm.).

The study conducted for the Davis-Grunsky Contract did not fully consider the minimum instream flow requirements of the juvenile salmon that are present in the stream during early and late spring. Relatively large spring releases have been shown to increase the survival of downstream migrants and thus the escapement three years later (see New Melones Case Study #50).

In January 1970 the DFG initiated a 3 year study to determine emigration patterns of smolting king salmon in the Merced River. The purpose of the investigation is to develop recommendations for scheduling increased water releases from New Exchequer and Crocker-Huffman Dams to optimize survival and emigration of juvenile king salmon in the river. The final results of the study have not been published yet, but some of the findings during the first year have been reported (DFG 1974).

Downstream migrants were trapped near the mouth of the Merced River and catch per hour was used as an indicator of the number of fish migrating. Two distinct periods of emigration were found to occur -- the first in February, was associated with peak stream-flows; the second in April and May occurred during low constant flows (see Figure 3). The fish migrating in April and May are larger and believed to have a better survival potential than smaller earlier migrating fish. However, low flows and poor water quality in the San Joaquin River system in the late spring and summer reduce the survival of these latter migrating fish (DFG 1974).

IV. Post-Project Conditions

During the time period between the completion of Crocker-Huffman Dam in 1910 and the construction of Exchequer in 1923 there was no information available describing the status of the fishery at that time.

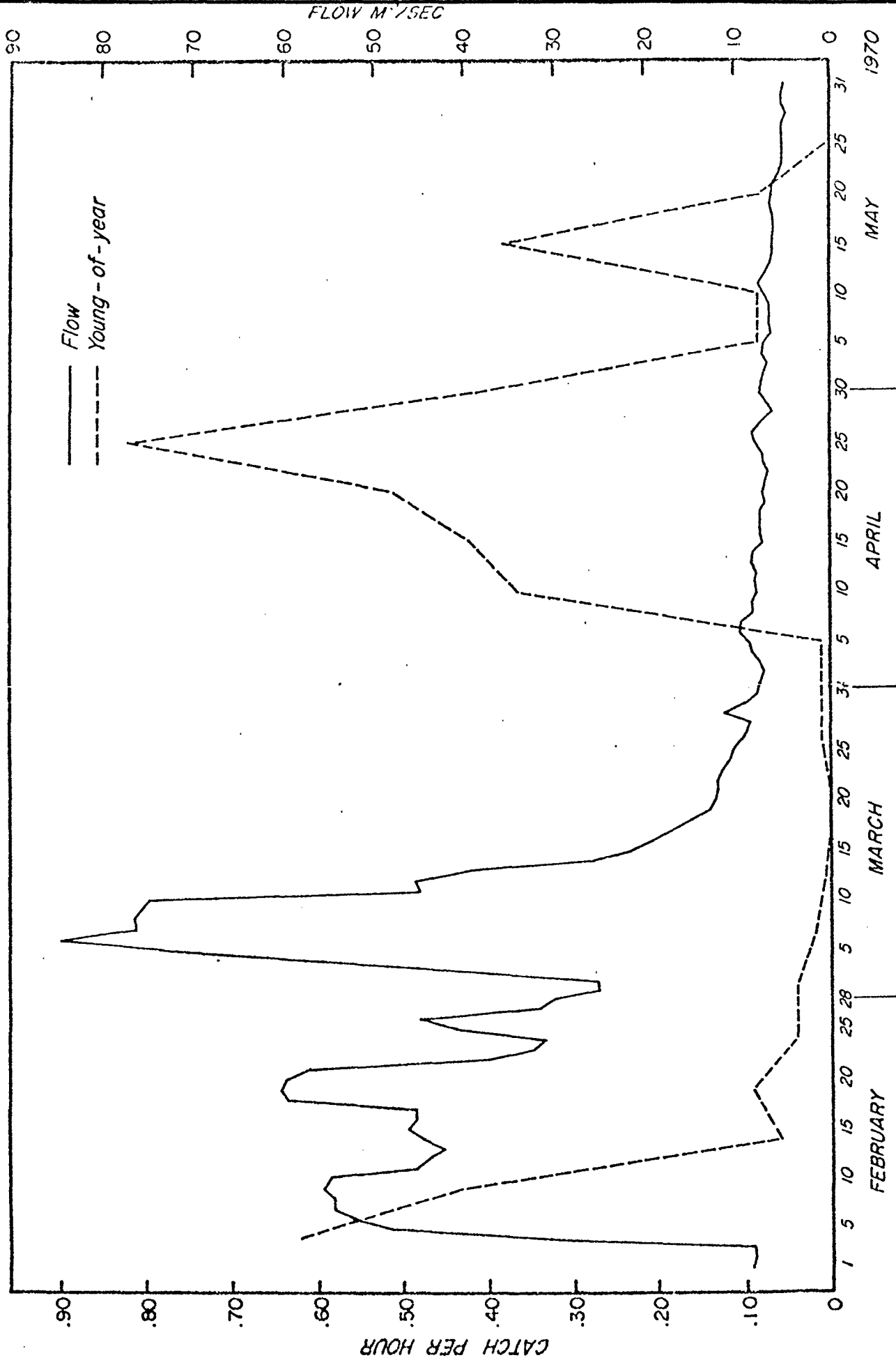


Figure 3
RELATIONSHIP OF FLOW TO JUVENILE SALMON MIGRATION AT GEORGE
HATFIELD STATE PARK, NEAR THE MOUTH OF THE MERCED RIVER, 1970

With the construction of Exchequer Dam in 1923 the DFG had estimated (1965) that there was 62 miles of king salmon habitat in the Merced River drainage with the absolute upstream limit at Exchequer Dam. However, only 25 miles contains spawning areas with the lower section used for transportation, and the fishways at Crocker-Huffman and Merced Falls Dams presented moderate barriers to salmon trying to reach the upper reaches of the spawning areas (DFG 1965).

Streamflows in the lower spawning areas below Crocker-Huffman had been low for decades prior to 1966, and this condition, along with the presence of small irrigation dams and ditches, limited the average abundance of spawning king salmon to about 100 fish per year (DFG 1965).

Since the operation of New Exchequer Dam (1966) and the implementation of the features of the Davis-Grunsky Contract, instream flow has averaged above 200 cfs as shown in the post-project hydrograph (Figure 2). In response to the increased instream flow regime and the operation of the spawning channel the king salmon populations utilizing spawning riffles and the spawning channels of the Merced River has increased as demonstrated in spawning stock survey estimates made by the DFG from 1967 to 1973 (as reported in DFG 1974).

<u>Year</u>	<u>Estimated Number of Spawning Adults</u>
1967	600
1968	500
1969	660
1970	5,000
1971	4,000
1972	3,000
1973	1,000

The Merced Spawning Channel was first operated in the fall of 1970. The production of the channel has been supplemented by Stanislaus River strain fry planted in the rearing ponds of the Merced installation. The rearing capacity of the installation was increased from 100,000 yearling salmon to 200,000 with the addition of a new pond in 1972 (DFG 1973).

V. Conclusions

The Snelling Project that was proposed by the Merced Irrigation District (MID) in 1954 was never undertaken but the original project which consisted of Crocker-Huffman Dam and the main irrigation canal was completed in 1910. From the inception of the original project in 1910 no evidence was found which indicated that consideration was given to instream flow reservation for fish and wildlife resources of the Merced River until completion of the New Exchequer Project in 1966. Streamflow alteration resulting from diversion of water during the irrigation season led to the decline of the king salmon populations in the Merced River during the period 1910 to 1966.

When the MID proposed the enlargement of Crocker-Huffman (Snelling project) in 1954, the DFG was able to establish instream flow reservation for fishlife. The DFG determined the minimum instream flow needs of the king salmon populations with a usable width method. This technique was again used by the DFG when a Davis-Grunsky contract was awarded to the district in 1966 and streamflows for the enhancement of king salmon were designed. Because the Snelling project was never undertaken instream flow reservation was made up from water storage in New Exchequer (Case Study Report #54).

Currently the DFG is reviewing the recommended streamflow release schedule and is in the process of modifying spring water release to optimize survival and emigration of juvenile king salmon.

The post-project salmon populations have increased from pre-project levels as demonstrated by DFG spawning stock surveys. This increase would tend to indicate that instream flow releases in the river below Crocker-Huffman Dam, along with the operation of the spawning channel and the screening of diversions, have all contributed to effectively maintaining the king salmon resource at pre-project levels.

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